

National Aeronautics and Space Administration

Office of Space Science

SPACE SCIENCE ADVISORY COMMITTEE

**August 5-7, 2002
NASA Headquarters
Washington, DC**

MEETING REPORT

Marc S. Allen
Executive Secretary

Andrew B. Christensen
Chair

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
August 5-7, 2002**

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**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
March 5-7, 2002**

Monday, August 5

Welcome and Chair's Remarks

Dr. Andrew Christensen, Chair of the SScAC, called the meeting to order and welcomed members and attendees. He introduced the new members on the Committee (Drs. Garth Illingworth, Jeremy Mould, Jack Mustard, Martin Kress, and Judy Karpen) and briefly reviewed the agenda.

Sun-Earth Connection (SEC) Division

Dr. Richard Fisher, Director of the SEC Division, reported on the status of events in his organization. Since the last meeting, the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission has been operational and has met its minimum mission requirements. Dr. Fisher showed some results from TIMED observations of the upper atmosphere and Ramati High Energy Solar Spectroscopic Imager (RHESSI) 4-D observations of solar flare events. He also reviewed the status of the current operating missions. They are a combination of remote sensing and in situ measurements. Three Solar Terrestrial Probe (STP) missions are in development: Solar-B, Solar Terrestrial Relations Observatory (STEREO), and Magnetospheric MultiScale (MMS). Dr. Fisher noted that the out-years missions are Geospace Electrodynamics Connections (GEC) and Magnetospheric Constellation (MC). Living With a Star (LWS) is aimed at the effects of the Sun and magnetosphere on the Earth and humanity. At present, the Announcement of Opportunity (AO) selection for the first mission, the Solar Dynamics Observer (SDO), is anticipated this month. A Definition Team has been formed to look at models and data systems for the Geospace LWS missions. LWS is broad reaching—both internationally and within the US. NASA is the lead agency for the International LWS (ILWS) program. The first international meeting is scheduled for September 4-6, 2002. In parallel, the informal national partnership is proceeding. The next meeting is scheduled for later this month. The agenda will include a “gap assessment” for the US program in space weather. Several SEC Explorer missions are in development. Two Missions of Opportunity (MoOs) are in development, and two Middle class Explorers (MIDEX) are in Phase A competitions. Dr. Fisher discussed SEC planning, which includes the recently released National Research Council (NRC) Decadal Study and the SEC Roadmap Study. In the Roadmap, an opportunity for a coordinated plasma experiment at L1 was identified, and SEC is implementing a plan for an L1 Cluster activity. SEC will also aggressively pursue strategic elements of the Solar Probe mission and well as a study to understand the mission model for a Jupiter Magnetosphere mission. Dr. Fisher showed a timeline of the SEC strategic plan through 2018, including STP missions, Earth Science missions, Small Explorer (SMEX) missions, MIDEX missions, and LWS missions. In response to a question, Dr. Fisher indicated that NASA will redirect funds for the L1 Cluster for the next two years, but will invite contributions from other agencies at the next meeting. There has been considerable dialog with NOAA over the last couple of months, and it is hoped that NOAA will step up to take on monitoring responsibilities at L1. With respect to LWS, he indicated that SEC is looking for an ILWS partner to share some of the costs.

Astronomy and Physics (A&P) Division

Dr. Anne Kinney, Director of the A&P Division, reviewed astronomy and astrophysics media successes in the past couple of months. She discussed the progress on the Space Infrared Telescope Facility (SIRTF), the status of Gravity Probe (GP)-B, and plans for a Beyond Einstein initiative. The Next Generation Space Telescope (NGST) is going through a phase change—the science team has been selected and the prime selection process is underway. SIRTF just completed thermal vacuum testing and gained some extra contingency and schedule. It is on track for a January 2003 launch. The General Observer (GO) call for proposals is on track for a November release. Dr. Kinney reviewed the SIRTF science objectives and the planned observations and studies. The forward equipment enclosure has been the source of some recent problems on GP-B. Current launch date is April 1, 2003. Dr. Kinney reviewed the overall status of the A&P operating missions and the status of Structure and Evolution of the Universe (SEU) missions in development. All A&P missions are “green.” The Galaxy Evolution Explorer (GALEX), GP-B and Swift are “yellow.” The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) is “red” because the level 1 requirements for sensitivity are not being met. The Gamma ray Large Area Space Telescope (GLAST) has

made considerable progress recently and everything is looking very good for the design review. Constellation-X (Con-X) and the Laser Interferometer Space Antenna (LISA) are proceeding as planned. An excellent package, Beyond Einstein, has been put together by the roadmapping team. Dr. Kinney also reviewed the status of Astronomical Search for Origins (ASO) missions. All are green except for SIRTf (yellow), NGST (yellow), and Keck (red, due to pending litigation with the Office of Hawaiian Affairs). Dr. Kinney reviewed the new hires (both civil servants and detailees) and job announcements in the Division. The Division intends to go forward with formal Intergovernmental Personnel Act (IPA) advertisements. The Decadal Survey suggested a Fellows Program, and Dr. Kinney has been in discussions with other OSS Division regarding a Space Science Fellows Program. In response to a question, Dr. Kinney noted that the next step on the technology activity is to try to get funding for the identified priorities. The independent technology assessment helps with the funding process and with every interface.

Solar System Exploration (SSE)

Dr. Colleen Hartman, Director of the SSE Division (SSED), provided an update on the status of SSE missions, the Nuclear Systems Initiative (NSI), the Decadal Survey, and the New Frontiers Program. The Division is still waiting for the 2002/2003 budget response from JPL on Rosetta. With respect to the Pluto mission, there are several concerns. The NEPA process and schedule are challenging and there is no out-year funding after FY02. There are some minor concerns on Genesis and Deep Impact. All other missions are green. The Discovery Program is green overall. DAWN and Kepler were selected for Phase B implementation. The operating missions are all green. Deep Space Network (DSN) is yellow because software deliveries are behind schedule. With respect to the NSI, a Science Concept Definition Team meeting was held last week at the University of Arizona. The central question involved the kinds of missions that would be enabled by 100-250 kWe available power. A SSED Technology Assessment Group was formed to assess and critique an integrated SSE technology program. Top priority areas were identified within the following categories: communications; in-space propulsion (ISP); local mobility/surface systems; avionics for space environments; guidance, navigation and control (GN&C); entry, descent, and landing; power generation; science instruments; and electronics in extreme environments. Assessing cost versus benefit for technology development proved to be extremely difficult in most areas. This made prioritization across technologies impossible. For spacecraft launched to Geostationary Transfer Orbit (GTO), the cost of the spacecraft, adjusted for complexity, is about \$75K per kilogram. The team found no real advantage for solar sails or nuclear systems, but this is due to our current way of thinking about missions—low mass, low power, etc. Dr. Hartman said we need to have concrete goals for technology programs or people take the money. The Decadal Survey endorsed Discovery missions at one launch every 18 months as well as a Cassini Extended mission. The five medium class missions in the NRC Report were: Kuiper Belt/Pluto (KBP), South Pole Aitken Basin Sample Return (SPA-SR), Jupiter Polar Orbiter with Probes (JPOP), Venus In-situ Explorer (VISE), and Comet Surface Sample Return (CSSR). Only one large class mission was identified as a mission priority—a Europa Geophysical Explorer (EGE). The Decadal Survey also identified small, medium, and large class priorities for Mars flight missions beyond 2005. The New Frontiers Program will include all planetary destinations except Mars. Launch would be no later than January 31, 2009. There would be no foreign launch vehicles or foreign RTGs. With respect to the Decadal recommendation on the Large-aperture Synoptic Survey Telescope (LSST), Dr. Hartman stated that this recommendation involved an implementation aspect that was beyond the purview of the Committee. Funding for ground-based astronomy is the responsibility of the National Science Foundation (NSF). NSF and NASA are trying to work out clearer lines of responsibility.

Mars Exploration Program (MEP) Office

Mr. Orlando Figueroa, Director of the MEP Office, provided an update on the MEP and discussed the status of the next decade planning. Mars Global Surveyor (MGS) is doing well under its second mission extension. Mars Odyssey is doing very well and is in full science mission status. ESA Mars Express is proceeding toward launch in 2003. Mars Exploration Rovers (MER) are the biggest current challenge. They are still preserving 50 days of slack against the launch schedule, but it will be a challenge to stay there. Mars Reconnaissance Orbiter (MRO) is healthy from a programmatic as well as technical point of view. On August 1, 19 full mission proposals and 5 MoOs were received under the Mars Scout Program. Selection is expected in early December. The MoOs may be on a more accelerated path. There is a technology demonstration planned for the French PREMIER-07 Science Orbiter; however, the budget for

the program in France is uncertain. This may mean a descope of the mission or a slip to 2009 or both. The Italian Space Agency (ASI)/NASA Science Orbiter is also uncertain. Italian budgets are unsettled, and it is not clear that G. Marconi will survive. NASA has a back-up plan to add this capability to the program using funds allocated for the joint ASI/NASA orbiter in 2009. The Mars Smart Lander (MSL) mission is in Phase A. The top issues for the MEP are: MER; technology readiness for 2009 MSL; the ASI commitment to G. Marconi and the NASA back-up plan; the robustness of the telecom and data management infrastructure; and plans for the next decade, including technology for sample return. For MER, 28 new scientists were selected to join the team. Eighty-six proposals were received for the Mars Research Program. The New Technology NRA for the Mars Program will be released in the next quarter. The Decadal Survey was highly supportive of Mars Exploration. The top priorities were consistent with the present Program science strategy, architecture, and this decade's plans. The medium class missions need cost verification. Actual implementation of Mars Sample Return (MSR) will be dealt with in the next decade's plans. Dr. Figueroa noted that he felt that the potential scientific contribution of the international missions was understated in the NRC survey report. The survey also touched upon programmatic issues, which he felt were inappropriate and not within the charter. With respect to planning for the next decade, there has been excellent support from the science community. There were three groups, focusing on exploration pathways, sample return, and astrobiology. The program has started to look at options to satisfy the exploration pathways. All of the data will be presented to the Mars Exploration Payload Assessment Group (MEPAG) in September and will be integrated into a draft plan in the December timeframe. In response to a question, Dr. Figueroa indicated that the Program is still proceeding with two rovers for the MER mission. Their status is "yellow" and will probably stay that way until launch. The rovers are currently in the Assembly, Test, and Launch Operations (ATLO) phase. All of the instruments have been delivered or are in calibration, and instrument risk has been retired. There are still issues with parachutes and some parts that have showed problems during qualification.

Report on the Education/Public Outreach (E/PO) Task Force

Dr. Paul Knappenberger gave a progress report on the Office of Space Science (OSS) E/PO Task Force, which was chartered to assess how well OSS has done in carrying out the E/PO Implementation Plan and whether adjustments in approach are needed. Members of the Task Force include a mixture of scientists, professional educators, heads of national associations, and personnel from museums. The final report will be provided to SScAC at its fall meeting. The Task Force reviewed the OSS E/PO strategy, the implementation plan, the Space Science Strategic Plan, annual E/PO reports, E/PO newsletters, and evaluation reports by the Program Evaluation and Research Group (PERG) at Lesley University. At the first meeting in April, there were discussions with the Associate Administrator (Dr. Edward Weiler), Mr. Frank Owens, and Dr. Jeff Rosendhal. The PERG reports were presented. At the June meeting, there were panel discussions with the Forum Directors and Broker/Facilitators. There were 275 registrants at the June meeting in Chicago, representing a growing E/PO community. The meeting helped establish better communications and connections. Issues were identified and proposed strategies were discussed. At the next meeting, there will be panel discussions with the mission E/PO leads and the OSS Discipline Scientists and Program Executives. The first results from the PERG Phase III evaluation study will be reviewed. Topics for Task Force analysis include: the scope of the program; the quality of the products and services; the coherence of content across missions; the E/PO support network; the involvement of the space scientist in the E/PO effort; the involvement of the minority community; professional development within the emerging E/PO community; how to make communications more effective, both internally and externally; and sustainability. In response to a question regarding professional training for E/PO, Dr. Knappenberger noted that this is one of the issues. There is a growing interest in E/PO, especially among the younger scientists, but there is little formal professional training available. Dr. Knappenberger noted one suggestion to connect them with the Broker/Facilitators. The first draft of the Task Force Report should be available in September. Dr. Rosendhal indicated that there may be a way to get the preliminary findings into the system sooner. Dr. Sellgren suggested consideration of an E/PO fellowship to address the professional training issue.

Discussions:

Each of the Subcommittee Chairs provided a brief overview of their Subcommittees' issues/concerns. Dr. McComas noted the issue of the L1 cluster. The Sun-Earth Connections Advisory Subcommittee (SECAS) felt that because of the spacecraft currently in operation there, the time is ripe for putting together data from

those missions. This was pulled out of the roadmap process and put into the recommendations in the letter. The second topic was international collaboration on LWS. The SECAS was happy to see international cooperation, but there was a spirited discussion on how to include contributions from other countries. In general, the SECAS felt that the LWS should be managed as a single international program, and that international partners should become part of the overall system. With respect to technology, solar sails is still a very high priority. Another high priority is highly autonomous, small satellites. The next topic was NASA/NSF collaborations, and the SECAS noted a couple of good examples of synergistic programs. The final significant topic was the issue of the availability of small launch vehicles. The Delta II will be phased out, and there are questions about the availability of small launch vehicles and opportunities for secondary payloads. For SEC, this is a serious problem, and the Subcommittee would like to see SScAC address this issue and perhaps take it to the NASA Advisory Council (NAC). Dr. Alok Das noted that there may be opportunities for secondary payloads on DoD launches. Dr. Heelis added that the secondary payload opportunity should not be considered a “fix” to the problem; the issue of launches for small payloads needs to be addressed. L1 monitoring becomes an important part of ground-based observations, but there is significant uncertainty on who will adopt the cause of monitoring conditions at L1 on a regular basis. Dr. Fisher noted that the JPOP that was identified in the Decadal Report did not appear in the last roadmap. This is an injection of a new interest into the program, and there will be discussions with SSE. There is conceivably cross-theme interest as well as areas of cross-theme synergy. At this stage, it should be addressed at the roadmap level. Dr. Christensen indicated that the SScAC should make a statement on the small launch vehicle issue. However, a clear case needs to be made before taking a recommendation forward to the NAC. Dr. McComas suggested that the SScAC get briefings on the facts at the next meeting and then form a recommendation to carry forward.

Dr. Drake noted several non-roadmap related items of interest. With respect to Mars, the community has now come together with a fairly unified vision. The SSES appreciated the efforts of Dr. Farmer and the MEPAG in this regard. There was a discussion on participating scientists on the MER, i.e., whether this should be a mechanism to get younger, relatively inexperienced people into the program. The SSES continues to have problem with Research and Analysis (R&A) funding, particularly in getting grants issued. This affects the majority of researchers in the NASA program. With respect to the Decadal Survey, the priorities for the first five years were roughly the same as the SSES priorities. The themes were also the same. This convergence was very reassuring. SSES is unique in having uncertainties in the New Frontiers area because of the Pluto mission. Implementation depends on what happens with the NASA budget. In terms of MER implementation, the decision “gate” was predicated on schedule. The program has managed to maintain schedule, so a decision on whether to drop one of the rovers did not need to be made. Dr. Hartman added that it was not clear that dropping one rover would provide the schedule recovery anyway. Currently, the second MER is not putting things at risk. Money and human resources are not the issue. Dr. Drake said JPL is doing very well and that workforce exhaustion is actually not an issue now. The second MER, according to Dr. Drake, is not putting the first one at risk. Dr. McComas noted that given the level of concern expressed at the last meeting, it was disconcerting not to get the details on the MER. Dr. Christensen indicated that he had asked Dr. Figueroa to provide additional information to the SScAC. In response to a request from Dr. Akin, Dr. Hartman indicated that she could provide the SScAC members the full report of the Technology Committee. Dr. Drake noted that the SSES does not currently have a technologist, and he asked Dr. Akin to review the Technology Assessment Group Report. In response to a question regarding the New Frontiers missions identified in the NRC report, Dr. Hartman indicated that the Division is looking at the missions in the “middle class.” With respect to the AO, the Division will identify the major science goals, and will let industry come up with the implementation. Dr. Drake added that if something in the New Frontiers “box” will fit under Discovery, it would be better done there. Also, if something identified as a large mission could fit as a New Frontiers mission, it would be foolish to exclude it. Currently, there is no line above a \$650 mission. In SSE and SEC, many of the high priority science missions cannot be done within the current ceiling “caps,” and the budget caps are prohibiting the high value science in an artificial way. At least once a decade, a large mission needs to be accommodated. Discussion recognized the gap at flight validation in the NSI program. Dr. Mustard asked about the New Frontier AO: Dr. Hartman said she will pull out the NRC science requirements, and this is what AO will solicit. Answering a question from Dr. Sellgren about highly recommended but unfounded missions, Drake said that the problem of the ceilings was endemic and included Mars sample return in addition to Pluto and Europa.

In response to the SScAC request, Dr. Figueroa provided additional information on the MER assessment. Areas that are normally reason for concern, e.g., software, are proceeding very well. The field programmable gate array (FPGA) failures are under investigation. This problem is not yet fully understood. Also, the parachute qualification failures are under investigation. The program is concerned, but the experts working on the problem are confident that this can be resolved. Landing site conditions present some concern. Odyssey is helping to understand the site questions. A decision on landing sites has been deferred until next spring. The program has provided additional \$100 million to the MER project; however, erosion of reserves remains a big concern. The workforce is not ramping down as planned, due to the hardware failures. The project has two teams (working two shifts), and to date there is no sign of distress. ATLO is proceeding much faster and smoother than typical. Dr. Figueroa showed the schedule margin on each of the rovers. They are still holding about 50 day slack, although rover 1 is starting to infringe on this margin. Dr. Figueroa also showed the ATLO critical deliveries and the threats/liens on the baseline workforce.

Dr. Dressler reported on the Origins Subcommittee (OS) meeting in June. The OS spent most of its time on the roadmap and the Government Performance and Results Act (GPRA) assessment. It also reviewed the missions. There are two working groups that have been appointed to go into more detail about issues of interest to the OS and the Structure and Evolution of the Universe Subcommittee (SEUS)—the Astronomy and Physics Working Group and the Science Archives Working Group. Both groups gave reports to the Subcommittee. There was also a discussion about the National Virtual Observatory (NVO) and the NASA Centers that are already doing aspects of NVO. The OS felt that the Center activities should not be diminished in the attempt to bring NVO on line. The OS received a report on the status of the Stratospheric Observatory for Infrared Astronomy (SOFIA) and will continue to watch this activity. In addition, there were reports on Terrestrial Planet Finder (TPF) and Starlight. Because of the NGST competition in progress, discussion on this program was very limited.

Freedom-to-Manage Committee Webcast Project

Dr. Marc Allen discussed the Webcast Project. This is a phased project to digitally capture a “voicescrpt” of advisory committee meetings for posting on the Web. The demonstration will be assessed for viability, interest, and impact. This project is in-line with one of the initiatives in the President’s Management Agenda (“Expanded Electronic Government”). It could provide expanded public access to advisory committee meetings. Ultimately, it might lead the way to advisory “virtual meetings” that would remain Federal Advisory Committee Act (FACA)-compliant. The project will utilize a phased approach. At this meeting, one presentation will be captured and posted on the Internet (the presentation on the Strategic Plan Next Steps and November Workshop Plans on August 7). At the November workshop, one or more presentations will be captured and posted from a remote location. If all goes well, the presentations at the February/March meeting will be completely captured and posted. The June/July meeting will be fully captured, including questions and remarks. Assessment will be ongoing.

Office of Aerospace Technology (OAT) Technology Programs and Planning

Dr. Harley Thronson introduced the technology topic that was requested by the SScAC at its last meeting. For almost a year, OSS and OAT have been meeting regularly to develop a plan that will coordinate technology funding to achieve long-range OSS missions goals via the OAT Pioneering Revolutionary Technology (PRT) program. The first opportunity will be a FY03 NASA Research Announcement (NRA). There have been extensive discussions with OAT on a variety of processes to infuse mid-Technology Readiness Level (TRL) technologies into missions. The OSS technology priorities are derived directly from the Division roadmapping activities. The Program Manager for PRT, Mr. Dennis Andrucyk, gave a presentation on OAT technology programs and planning. He noted some PRT technologies that have already been selected for use on Space Science missions. OAT funds technology in the infancy stages (TRL 1-3). These are picked up by the Enterprises as they mature. In response to a question, Dr. Thronson noted that there is not a plan to have an OSS mid-TRL technology “line.” They are picked up within the project lines. Elements of the Cross-Enterprise Technology Program are within the PRT line. PRT has two primary goals: engineering innovation and technology innovations that will find their way into systems. Mr. Andrucyk described the three programs within PRT. A lot of the technologies for space systems are included under the Enabling Concepts and Technologies Program. About \$30 million in FY02 is going

into NRAs for space technologies. There will be another NRA in 2003. OAT is working toward establishing a rigorous and comprehensive systems analysis methodology for technology investments that will factor in the future mission needs of the NASA Enterprises. It will strive for a balanced program that meets the needs of the Enterprises with a variety of TRLs. Currently, OAT is working with the NRC on their review of the OAT Program. Dr. Thronson stated that he is taking the priority technologies (three or four from each theme) from the technology roadmaps and presenting them to OAT. Some of these priorities will be included in the PRT plan. OSS has produced a "Technology Blueprint" to identify OSS technology requirements. This will be updated after the Strategic Planning workshop. In response to a question, Dr. Thronson clarified that the document represents "requirements." It is not a funding document.

OSS Status and Q&A

Dr. Edward Weiler, Associate Administrator of OSS, provided a status report on the Space Science Enterprise. Since the last meeting, the Administrator has declared a new NASA vision and mission. The Space Science vision (produced four years ago) fully supports the new NASA mission. All of the Enterprises will be managing by "themes" (modeled on how OSS manages). Dr. Weiler showed the FY03 budget recommendation. So far, the Senate Appropriations Committee has added \$105 million for the Pluto/New Horizons mission and taken \$16.5 from the JPL Flight Projects Facility. This cut will affect the Mars Program. There were also cuts to Nuclear Power and Nuclear Electric Power, primarily because they were "easy targets" and money was needed elsewhere. There were a couple of funded earmarks added by the Senate. Dr. Weiler emphasized that this is the current status of the budget on the Hill; it is not necessarily indicative of where the process will end up. With respect to changes in Program Management, the center of gravity of program/project control is shifting towards Headquarters. In addition, the Lead Center concept is changing. Each Center will now be responsible to the Enterprise for its own work. No Center will be subservient to another. Management oversight at the program level will be through the Enterprise Program Management Council (EPMC). With respect to previous SScAC recommendations, Dr. Riegler will update the Committee on the status of the competed/non-competed research budget. The briefing on NASA/NSF Astronomy coordination will be given at the next SScAC meeting. In terms of technology and the OSS relationship with OAT, the presentation was on the agenda for this meeting. Likewise, the E/PO Task Force provided its update at this meeting. In terms of representation of biology on the Subcommittees, Dr. Weiler noted that biology representatives exist on both the OS and the SSES. SECAS is evaluating the necessity of the position. OSS is re-evaluating committee membership in general. OSS recognizes the problem with small launch vehicles. Schedule constraints for this meeting agenda required that this topic be deferred until the next meeting. In response to a comment, Dr. Weiler agreed that the Earth Science Enterprise also has a small launch vehicle problem. Dr. Weiler clarified the association of the Divisions, "lines," and themes. The ASO and SEU themes both sit in the A&P Division. In addition to the planetary missions, SSE includes Mars science, all the R&A that feeds the planetary community, the Discovery Program, New Frontiers, NSI, Astrobiology, and DSN. Mars Exploration has one funding line and has all of the funds for Mars except for the science. SEC includes STP, LWS, Explorer, New Millennium, rockets, and all of the R&A that feeds the space physics community. ASO includes the Navigator Program. With respect to staffing, OSS has tentative approval for up to 120 people; it is currently around 90. One of the actions after the Mars failures was to increase responsibility and control at Headquarters and start staffing up the Headquarters function. Dr. Weiler noted that starting in FY04, OSS will be under full cost accounting. In response to comments, he discussed the hypothetical impact of using a Shuttle mission for OSS payloads. Dr. Sellgren asked for a correlation among the five themes and the major line items. Dr. Weiler indicated that he could provide the SScAC with this information. In response to a question regarding his top concerns, Dr. Weiler indicated that his major concern is MER. It must be successful. The second major concern is resolving the Pluto issue. The third biggest concern is community members who want to sacrifice NGST for another Hubble Space Telescope (HST) servicing mission. The most positive thing OSS does is get science into the schools and excite American school children. Congress recognizes what OSS does in education, and this has been a big positive for the Enterprise. The Agency as a whole is putting much more emphasis on education, and it is now one of the core missions of the Agency.

Preview of GPRA Discussions

Mr. Allen reviewed the GPRA requirements and provided an overview of the science assessment process. OSS depends on the SScAC and its subcommittees for external science assessment. Within the Enterprise Science Objectives are 24 Enterprise Research Focus Areas (RFAs). Dr. Allen showed the mapping of the objectives and RFAs to the OSS Divisions and themes.

SEUS GPRA Report

Dr. Kolb presented the SEUS assessment on the SEU-related RFAs, as well as the basis for the assessment:

- 1) Identify dark matter and learn how it shapes galaxies and systems of galaxies—green
- 2) Determine the size, shape, age, and energy content of the Universe—green
- 3) Discover the sources of gamma-ray bursts and high-energy cosmic rays—green
- 4) Test the general theory of relativity near black holes and in the early Universe, and search for new physical laws using the universe as a laboratory—green
- 5) Reveal the nature of cosmic jets and relativistic flows—green

The SScAC concurred with the Subcommittee ratings.

OS GPRA Report

Dr. Dressler presented the OS assessment on the OS-related RFAs, as well as the basis for the assessment:

- 1) Observe the formation of galaxies and determine the role of gravity in this process—green
- 2) Establish how the evolution of a galaxy and the life cycle of stars influence the chemical composition of material available for making stars, planets, and living organisms—green
- 3) Observe the formation of planetary systems and characterize their properties—green
- 4) Discover planetary systems of other stars and their physical characteristics—blue
- 5) Search for worlds that could or do harbor life—green

Number (4) was rated blue because of the first direct detection of the atmosphere (using HST) of a planet orbiting a star outside our solar system. In addition, 2MASS revolutionized our understanding of the solar neighborhood with this discovery of field brown dwarfs, leading to modification of the century-old spectral classification system.

The SScAC concurred with the Subcommittee ratings.

SSES GPRA Report

Dr. Drake presented the SSES assessment on the SSES-related RFAs, as well as the basis for the assessment:

- 1) Inventory and characterize the remnants of the original material from which the Solar System formed—green
- 2) Learn why the planets in our Solar System are so different from each other—green
- 3) Learn how the Solar System evolves—green
- 4) Investigate the origin and early evolution of life on Earth, and explore the limits of life in terrestrial environments that might provide analogues for conditions on other worlds—green
- 5) Determine the general principles governing the organization of matter into living systems and the conditions required for the emergence and maintenance of life—blue
- 6) Chart the distribution of life-sustaining environments within our Solar System, and search for evidence of past and present life—green
- 7) Identify plausible signatures of life on other worlds—green
- 8) Understand forces and processes, such as impacts, that affect habitability of Earth—green
- 9) Find extraterrestrial resources and assess the suitability of Solar System locales for future human exploration—blue

Number (5) was rated blue because for the first time, irradiation of ices deposited under interstellar conditions has demonstrated the synthesis of molecules capable of self-assembly, forming proto-cells. Very similar proto-cells have been discovered in the Tagish Lake meteorite. In another area of research, proteins have been found to be capable of self-replication and also to have chiral selective behavior. This is the first experimental evidence of a system of proteins preferentially selecting a single chirality. The SScAC felt that number (6) should also be blue because of the large amount of water-ice discovered on Mars. Minor changes to the supporting narrative were suggested for some of the RFAs.

The SScAC concurred with all of the other Subcommittee ratings.

SECAS GPRA Report

Dr. McComas presented the SECAS assessment on the SECAS-related RFAs, as well as the basis for the assessment:

- 1) Use the exotic space environments within our Solar System as natural science laboratories and cross the outer boundary of the Solar System to explore the nearby environment of our Galaxy—green
- 2) Understand the origins of long-term and short-term solar variability—green (borderline blue)
- 3) Understand the effects of solar variability on the solar atmosphere and heliosphere—green
- 4) Understand the space environment of the Earth and other planets—green
- 5) Develop the capability to predict space weather—blue

Even though it is just starting, LWS is starting to get some real results, and number (5) was rated blue. The SScAC felt that number (3) was a solid green, but not blue.

The SScAC concurred with the Subcommittee ratings.

Summary of Discussion on GPRA Assessments

The SScAC agreed that there were no areas that should be yellow. Dr. Dressler raised the issue of how the slip in the SIRTf schedule would be recognized. Although this is a programmatic milestone, it affects the science data that was expected to be obtained this fiscal year. The question is the degree to which the science is compromised. Dr. Allen indicated that the Committee could make a statement on how the science was negatively impacted by the slip in SIRTf. Some of the members felt that the best place to address the slippage in SIRTf would be in the letter, rather than downgrading the science performance assessment in a particular area. Dr. Christensen indicated that he would do the “roll-up” of the GPRA performance rankings and present it to the Committee on the following day.

Tuesday, August 6

Before beginning the formal presentations, Dr. Christensen reviewed the writing assignments for the Committee.

Review of Space Studies Board (SSB) Activities in Support of Planning

Dr. Joseph Alexander provided an overview of recent studies relevant to strategic planning in OSS. The SSB has developed decadal science strategies for almost the entire OSS program. They address more than NASA, e.g., the NSF and other areas of Federal support that are relevant in the fields. SSB decadal strategies for astronomy and astrophysics have a long history. Early last month, the SSB released the first decadal strategy in SSE. In addition, there have been numerous assessment studies, including an assessment of the Astrobiology program. Today, the SSB is releasing the third in the decadal strategy series that covers Solar and Space Physics. Other projects completed in 2002 include a study on usefulness and availability of data from Earth and space missions and a study on precursor measurements necessary to support human operations on Mars.

Report on SSB Sun-Earth Connection Decadal Survey

Dr. James Burch presented the report on the decadal survey on solar and space physics. The charge was to conduct a broadly based assessment of the scientific priorities of the US solar and space physics research programs and recommend priorities for 2003-2013. It was also charged to address the human aspects of the field and suggest promising areas for the development of new technologies. The study was community-based and national in scope. Dr. Burch noted that the recommended initiatives are consistent with a realistic resource envelope. The Survey Committee was composed of five panels, with adjacent areas of interest working together. Dr. Burch described the study organization and process, including community input, selection, and prioritization. The SSB identified six scientific themes and challenges. The prioritization criteria used were: scientific merit (the most important); contribution to national goals; and programmatic aspects, e.g., technological readiness, timing, synergy with other programs. Following the astronomy structure, the program categories were split into large (over \$400M), moderate (\$250M to \$400M), and small (less than \$250M). In addition, the SSB identified a “vitality” category for programs relating to the infrastructure that would be essential for the health and vigor of the field. Dr. Drake noted that the dollar ranges were not the same as those used for the SSE study. The committee recommended only one large program—Solar Probe—for implementation as soon as possible. Interstellar Probe was also

considered to be a high priority future mission, but not technologically feasible during the period covered by the study. A number of moderate programs were identified, prioritized according to the criteria described earlier: MMS; Geospace Network (part of the LWS program); Jupiter Polar Mission; Multi-spacecraft Heliospheric Mission (identified as Solar Sentinels in the Strategic Plan); Geospace Electrodynamic Connections; Suborbital Program; MC; Solar Wind Sentinels; and Stereo Magnetospheric Imager. All of these missions have been included in SEC roadmaps. Dr. Burch noted that if a program already had an AO, it was assumed to be “real” and not included in the rank. Small programs include: Frequency Agile Solar Radio Telescope; Relocatable Atmospheric Observatory; L1 Monitor; Solar Orbiter; Small Instrument Distributed Ground Network; and University Explorer (UNEX). The first two are ground-based programs supported by the NSF. The SSB recommended L1 Monitor implementation by NOAA. Solar Orbiter is an ESA Program. The Small Instrument Distributed Ground Network is also a NSF program. The Vitality Programs include the NASA SR&T Program, the National Space Weather Program, two theory and modeling programs (Coupling Complexity and Virtual Sun), the Solar and Space Physics Information System, the NASA Guest Investigator (GI) Program, and the Geospace Theory Program. Dr. Burch showed the cost estimates (in FY02 dollars for development phase) used for the programs. All of the medium size missions are in the \$300M to \$400M range. The SSB did not recommend an implementation approach for the Jupiter Polar Mission. It could be a Discovery mission, a Solar Terrestrial Probe, part of a New Frontier mission, or a “new start” mission. Dr. Burch provided further information on some of the recommended missions. He showed the timeline of mission costs, one with Solar Probe start in FY03 and one with Solar Probe start in FY09. If Solar Probe is started in FY03, new money would have to be found. The expected budget could accommodate a Solar Probe start in FY09. The Survey Committee gave high priority to several initiatives recommended by the Panels, but did not include them in the integrated program because of the overall budget constraint, mission sequencing requirements, or technical readiness issues. There were numerous technology recommendations, e.g., advanced propulsion and power technologies. The Committee recommended more planning, cooperation, and coordination between NASA and NOAA. With respect to access to space, the SSB recommended that NASA revitalize the Suborbital Program to bring the flight opportunities back to previous levels. The Discovery Program may be one mechanism to do planetary missions in SEC. The SSB recommended that the scientific objectives of the Discovery Program be expanded to include frontier space plasma physics research subjects.

Discussion:

In response to a comment, Dr. Burch noted that the problem with UNEX, from the perspective of OSS, is that there is not a \$1M launch vehicle. It would have to be a “piggyback” launch. If there are opportunities for piggyback launches, e.g., through DoD, then that approach should be formalized. With respect to workforce, the SSB recommendation was related to a stable pool of engineers and PIs at the universities. The recommendation was to fund “bridge” positions for a few years.

Report on SSB Solar System Exploration Decadal Survey

Dr. Joseph Burns discussed the SSE decadal survey. The charge to the committee was to conduct a broad survey of the current state of knowledge about our solar system today, identify the top-level scientific questions, and draft a prioritized list of the most promising avenues for flight investigations and supporting ground-based activities. The effort was modeled on the NRC astronomy decadal surveys. The committee was asked to break down the priorities within three “cost bins” and to prioritize the Mars Program and SSE Program independently. Dr. Burns reviewed the study process. A large amount of community input was obtained. Dr. Burns discussed the relationship between the motivational questions (Are we alone? Where did we come from? What is our destiny?) and the scientific goals. The committee identified four overarching themes—the first billion years of solar system history, volatiles and organics, the origin and evolution of habitable worlds, and how planetary systems work—and twelve key scientific questions. As requested, the committee addressed mission priorities for new solar system flight missions (non-Mars), Mars flight missions (beyond 2005), and new ground-based activities. The flight missions were split into three cost classes: small (less than \$325M), including Discovery, Scout, and mission extensions; medium (less than \$650M)—New Frontiers missions; and large (over \$650M)—Flagship missions. The criteria used for judging priorities were scientific merit, opportunity, and technological readiness. Within the small class, the top priorities were Discovery missions at one launch every 18 months and a Cassini Extended mission (CASx). Priorities for New Frontiers missions were: KBP; SPA-SR; JPOP; VISE; and CSSR. Dr.

Burns noted that the votes on ranking were very consistent. In many cases, the discriminator in the ranking was technological readiness. The top priority flagship mission was EGE. Dr. Burns described the goals of EGE and each of the New Frontiers missions. The committee felt that technology is key to the future, but did not have the time to prioritize it. For Mars flight missions, the small class priority was the Mars Scout line and a Mars Upper Atmosphere Orbiter (MAO). The medium class priorities were MSL (in the queue) and Mars Long-lived Lander Network (MLN). The large class top priority was MSR preparation so that its implementation can occur early in the next decade. The committee endorsed the Astronomy and Astrophysics Survey priority for LSST. It recommended a joint venture with NSF. Dr. Burns reviewed the programmatic recommendations: continue vital ongoing programs; adjust R&A programs to be consistent with the new program; establish New Frontiers (competitively selected missions capped at \$650M); fly flagship missions once per decade; support organizations providing vital services; and facilitate international ventures. It also recommended that astrobiology objectives be integrated with those of the other disciplines. Although it approved of a competitive approach for New Frontiers, the committee was concerned about some of the aspects of competitive selection for these missions, e.g., secrecy during the conceptual phase, a substantial increase of overall costs in the pre-selection stage, and conflict of interest at NASA Centers.

Discussion:

In response to a question, Dr. Burns noted that the committee was excited by the NSI in the President's budget. However, for missions in the next decade, the committee felt that those capabilities would not be there. Dr. McComas raised the issue of cost for New Frontiers missions. Dr. Burns noted that the JPOP mission is the joining of two Discovery missions (at \$325 million each). In a Principal Investigator (PI)-driven mode, there may be some clever ways to reduce costs. To maintain the integrity of the program, some missions may have to fall off the table if they cannot be done within the cap. The committee received a presentation from Dr. Hartman on the run out budget of the next five years. It extrapolated from those numbers and was somewhat aggressive on the list for New Frontiers. If some of the "flagship" category missions could be done within the New Frontiers cap, the ranking within the moderate category could change. There was a consensus view that at the beginning, the missions in New Frontiers should be approached in rank order, but the ordering should be revisited after there is some experience.

Report on Activities of the SSB Committee on the Origins of Life

Via telecon, Dr. Jonathan Lunine reported on the SSB Committee on the Origins of Life. He discussed the role in the decadal strategy, provided a brief summary on its report, and discussed the future of the committee. The committee was chartered to assess the direction of the NASA astrobiology program, survey initiatives for seeking life in the universe conducted by other US Federal and nongovernmental groups, identify enhancements to the US program, and recommend areas for coordination of NASA efforts with those of other parties. This is the second major report that the committee has done. The committee commended NASA for the progress made in the past five years in organizing the astrobiology program, for recognizing the high value of R&A programs related to astrobiology, for the present level of involvement of the astrobiology program in flight missions, and for developing a well-balanced SSE program as a foundation for the central endeavor of astrobiology. The committee had several recommendations. NASA should tighten the definition of astrobiology to focus directly on a selected set of issues relating to this origin, evolution, and the ubiquity of life in the cosmos. NASA should recognize the operational goal of astrobiology to inform NASA missions with respect to the techniques and targets for the search for life. NASA should foster more extensive links between astrobiology and ASO programs. NASA should study the feasibility and desirability of creating and funding an institute, akin to the NASA Astrobiology Institute (NAI), dedicated to consortium-based science and technology development relating to ASO. Astrobiology abroad has blossomed. It is an example of the US leading the rest of the world into a new discipline area and new forms of research. The committee found that the leadership of the SETI Institute has forged a unique endeavor out of private and public funds, maintained a high standard of scientific research through its peer-reviewed research activities, and has created a viable, on-going enterprise. Overall, the committee felt that the astrobiology program deserved a lot of credit for growing and maturing in an era of tight budget. With the release of this report, Dr. Craig Wheeler will take over as Co-Chair. Future plans are to do a study on what can be quantified about life that is different from life on Earth. The other possible project that the committee might work on is to further examine the integration of ASO with astrobiology.

Discussion:

Dr. Dressler indicated that the OS was enthused that the committee recommended more interaction and integration between astrobiology and ASO. He agreed that another institute would be a possibility to consider. Dr. Lunine observed that it would be an interesting question on how an Origins Institute and an Astrobiology Institute might work with each other. Dr. Farmer asked about the committee's impression of the new roadmap with respect to "tightening" astrobiology. Dr. Lunine indicated that the group as a whole did not look at the roadmap, although individuals on the committee did. It is a more selective roadmap and tends to sharpen the issues. A capstone to the roadmap would be a powerfully written, succinct description of the core issues of astrobiology, at a level of detail beyond the three big questions but with enough generality that it could be captured and understood by the community and the public. In general, the new roadmap is moving in the right direction.

Committee Discussion

Dr. Christensen observed that there did not appear to be major disconnects between the Subcommittee roadmap activities and the SSB Reports.

The Committee engaged in further discussion on the writing assignments. With respect to L1, Dr. Heelis noted that the question is whether the Committee should recommend that NOAA take on this responsibility or that NASA and other interested parties develop a plan that will ensure monitoring of the interplanetary environment. Dr. McComas stated that NOAA has wanted to do this for some time. The problem is that the agency has not been able to obtain funding for the project. Measurements on solar wind are needed for both operational and scientific purposes. Dr. Drake noted that to realize some of the SSE goals, there should be a funding line for "flagship" missions. Currently, there is inconsistency among the OSS Divisions with respect to the dollar range for small, moderate, and large classes of missions. The SScAC discussed the issue of cost "caps" for the missions. Dr. Drake said there will come a point where all the things that can be done cheaply will have been done. Dr. Kolb did not agree with the idea of calling for an increase in the cost caps. The other problem is the need to have, about once a decade, in each theme, "flagship" missions that won't fit in any cost cap. Dr. Das points out that with five themes a billion dollar mission for each one, the total comes to \$200 million per year. Dr. Sellgren said that if there won't be any small launch vehicles, low cost cap missions won't be an option anyway.

Science Talk: "View of the SEC from the Upper Atmosphere"

Dr. Janet Kozyra gave a lunch time talk on a new view of the Sun-Earth Connection. A series of events has occurred that is giving us a new perspective on how the Sun-Earth interaction works. A systems view (LWS) will help understand this connection. We can finally trace the drivers of upper atmospheric disturbances all the way to the Sun. Dr. Kozyra showed two examples of how the solar and heliospheric drivers propagate through the Sun-Earth system. Fifteen different spacecraft teams have contributed to studying a solar flare on April 21 this year. For the first time, the structure of magnetic loops and production of x rays was imaged. The solar proton event started on April 21 and didn't return to background levels until April 27. Transport through the heliosphere affects the energy and variability of lower energy solar protons. Solar protons filled the polar cap and enhanced the radiation belt. The chemistry was clearly impacted by solar particle events, but the change in NO did not peak at the time of the solar particle event as first expected. The situation is more complex. Another change involves the magnetic activity triggered by the coronal mass ejections. Dr. Kozyra described magnetic storms and sub storms and what we see during these storms at all local times. A large-scale feature like the ring current is being modulated. Because of changes in the electric field, the plasmasphere becomes highly structured. We now have a way to look at the fine scale structure. In addition, there is supporting information from other spacecraft. Coupling between small-scale processes and global system response is an important and little understood aspect of geospace. Dr. Kozyra discussed the four key features of the upper atmospheric response: change in NO chemistry; neutral composition changes; ionospheric density depletions and enhancements; and penetration of the solar wind electric field all the way to the equator. NO plays an important role in the upper and middle atmosphere. For the April event, she showed the changes in NO from TIMED observations. The April 2002 events address new science and fundamental understanding of the coupling and feedbacks in the Sun-Earth chain. A workshop is planned for August 7-8, 2002, to support community analysis.

Report on the SEUS Roadmap

Dr. Kolb gave an update on the upcoming 2003 SEU roadmap. For SEU, the Roadmap Team is not identical to SEUS. There is a technology subgroup and an E/PO subgroup. In April SEUS confirmed the priorities and strategy. A draft text exists and has been on the SEUS website since July. Tomorrow, the roadmap team meets at Headquarters and the roadmap will be presented to SEUS on August 8-9. The roadmap is aligned with the NAS Committee on Gravitational Physics (1999), the OSS/SEU 2000 roadmap, the NAS Physics Survey (2001), and the recent NAS astronomy and Astrophysics Survey Committee (2001). Dr. Kolb reviewed the top-priority science missions in the 2000 roadmap. The 2003 roadmap has one program, Beyond Einstein, that is the highest priority. Other SEU science (Cycles of Matter and Energy) is the next highest priority. The three key questions in Beyond Einstein are: What powered the Big Bang? What is at the edge of a black hole? and What is the dark energy? The Beyond Einstein program has three parts: “flagship” strategic missions—Constellation X and LISA; Einstein Probes—\$350M missions launched every three years starting in 2010; and a technology program to enable the Vision Missions (after 2015). E/PO is being taken very seriously. The public is very interested in dark energy, black holes, and the big bang. The Roadmap Team is coordinating with Origins. Many of the science issues and cycles of matter are similar to Origins.

Report on the OS Roadmap

Dr. Dressler reported on the status of the Origins roadmap. It is well established, but evolving. The OS and others from the community worked on the science section of the roadmap. There are three science chapters that run along the three themes of Origins. In addition, there is an R&A chapter, a mission chapter, a technology chapter, and an E/PO chapter. The draft of the roadmap has been completed and is being “polished.” The flow of the roadmap is hierarchical, from general descriptions that can be understood by a non-technical person, to very technical investigation descriptions. The OS has struggled with how to address precursor science. The OS has also struggled with how to tackle future, follow-on missions. The biggest challenge has been how to show the depth and breadth of the program. In response to comments on the themes in the roadmaps, Dr. Dressler indicated that the thematic approach is a good way to approach the science. In addition, it brings in the support of a large range of the community. The consequence of pushing the wavelength, bottoms-up approach is a factoring of the community. The thematic approach helps bring groups together. The only thing that frustrates the flexibility of the approach is the size of the missions.

Report on the SSE Roadmap

Dr. Drake provided an update on the SSE roadmap. The SSB decadal survey did a very good job; it is very consistent with the first five years of the SSE roadmap. There is a unified picture coming out of planetary science at the highest level. The SSES will adopt the survey themes: the first billion years of solar system history; volatiles and organics: the stuff of life; the origin and evolution of habitable worlds; and processes: how planets work. The decadal survey report has a strong intersection with the roadmap missions. The survey tied the proposed missions to the 12 key science questions and themes. A number of the missions satisfy more than one theme in SSE. There are a series of small missions as well as a series of medium size missions. The roadmap will probably address cost caps. It is not clear that the medium size missions will fit within the \$650M cap. The SSES prioritized Pluto ahead of Europa, primarily because of orbital dynamics. In response to a question, Dr. Drake indicated that the SSES has not decided the extent to which it will capture directly from the decadal survey. It is currently in the writing process. There are first drafts on three sections. The SSES intends to have a complete rough first draft by September 1.

Report on the SEC Roadmap

Dr. McComas reported on the status of the SEC roadmap. Because of timing constraints, the SEC went ahead with the roadmap process independent of the corresponding SSB decadal survey. However, the decadal survey matches well with the SEC roadmap. There are no major disconnects. The SEC approach was to have a roadmap team independent of the Subcommittee, and use the SECAS as a “red team” review group. The team tried to follow the guidelines provided by Dr. Allen. A section on critical external factors that could have a positive or negative effect on the program is being added. The biggest complaint with the last strategic plan process was that all of the SEC science rolled up onto one objective. The team came back with three irreducible primary objectives that cover SEC. The three objectives can be laid against the two mission lines: STP and LWS. Dr. McComas reviewed the RFAs under each of the SEC objectives.

Dr. Allen noted that the roadmap text contains terminology that is unfamiliar to someone without a technical background. He suggested that the SECAS consider narrative that can be read and understood by a non-technical person. Dr. McComas noted that Solar Probe did not seem to “fit.” This presents a challenge to the team, and it will have to be approached in a different way. The roadmap team is still working on the long term mission section. Dr. Beichman suggested a format (table or matrix) showing the cross-coupling with other themes, e.g., Origins. In addition to the science part of the roadmap, there is a technology section. The highest priority technologies have been identified: multiple spacecraft challenges, information technology, solar sails, and scientific instrumentation. Next tier priority technologies are power systems and communication systems. The roadmap team has performed very well and represents the community. There was a red team review at the last SECAS meeting, and substantial rewrite by the roadmap team is in progress. There was a glitch in getting astrobiology input, and someone is still needed who can read that section and make suggestions. The team is on track to meet the schedule.

Review of Roadmap Guidelines and Schedule

Dr. Allen provided a synopsis of the roadmap presentation style and reviewed the key contents. The content draft is due to Headquarters on September 3. For the workshop on November 6-8, 120 copies are needed. In response to a question, Dr. Allen noted that the aggregated Strategic Plan must be intelligible to well-educated people who are not scientists. The roadmap may be slightly more technical, but terms of art, e.g., “couplings,” should be avoided. A glossary (as an appendix) would be extremely useful. Names and affiliations of contributors should be included in an appendix. Dr. McComas requested that Dr. Allen send the guidance on key contents to the Committee electronically. The first draft of the Strategic Plan will be circulated for review (SSB, SScAC) in early February. SScAC will do a final review in July 2003, with release of the Plan targeted for September 2003.

“One NASA”: Integration of Long Range Planning

Over the last few years, the Enterprises have been supporting a long range, cross-Enterprise planning activity. Dr. Thronson introduced a very high level, broad-brush view of the exploration strategy and the technology strategy. Dr. Gary Martin reviewed the history of the NASA Exploration Team (NEXT). It was chartered in June 1999 as the Decade Planning Team (DPT) to create an integrated strategy for science-driven space exploration. It was a coordinated team (over 100 senior participants) from across the entire Agency. It focused on revolutionary approaches and developed alternative scenarios, architectures, and mission concepts to achieve NASA science goals beyond a 10-year horizon. It developed technology roadmaps, investment priorities, and initiatives. It is an on-going, cross-Enterprise activity with a new formal charter, reporting to the Associate Administrators. The DPT laid out example science questions for exploration of life in the universe. New NASA policy is that science drivers determine the destinations, not vice versa. NEXT adhered to a process that took as a given the Space Act, the NASA Strategic Plan, and major science goals. The NEXT undertook mission requirements, systems engineering, and architectural studies and technology trades. As a consequence of the gap analysis, the NEXT determined the technology requirement, priorities, and new initiatives. The Exploration Strategy uses a “stepping stone” approach. As science questions are answered and technologies become available, there is an expansion of greater robotic and human exploration capabilities. We are currently at Earth and LEO; the next step is “Earth’s neighborhood.” Beyond that, the next obvious step would be accessible planetary surfaces, e.g., Mars. NEXT has looked at the priority capabilities that are necessary for each step in progressive space exploration. To enable the exploration strategy, five broad capabilities are needed: space transportation; affordable, abundant power; crew health and safety; optimized robotic and human operations; and space system performance. Dr. Thronson showed a more specific listing of the top 10 R&D areas for technology investment and five summary roadmaps for the key technologies. He emphasized that NEXT is not laying out a path for the future; it is looking at option areas and is proposing technology initiatives to support decision making about the future direction of the Agency. In response to a question, Dr. Thronson stated that it is paramount that the science community have input and regular exposure to the long range planning activity of the Agency. The NEXT activity needs to be linked with the OSS planning process. The SScAC felt that there should be serious science feedback on the NEXT strategy, e.g., whether the human presence is needed in long-range science endeavors such as construction of large telescopes. There was considerable sensitivity about technology investment that doesn’t help space science in the next 10 years. The SScAC felt there was a disconnect between where the SScAC sees the Strategic Plan going and what was presented. Dr. Thronson indicated that one of the priorities for the coming year will be to connect the

strategic planning process for the next 10 years and the longer range strategic planning. The new initiatives, e.g., the in-space propulsion initiative and the nuclear initiative, are directly traceable the DPT activity and advocacy. Also, the most effective and complete analysis of the Space Launch Initiative (SLI) was done by the NEXT. Dr. Christensen agreed that coordinating the long range planning activity with the OSS strategic planning activity would be a good thing. Dr. Sellgren commented that the SScAC would feel more comfortable if it could be shown what technology investments are being planned or worked on by NEXT to enable the missions in the roadmaps.

*Wednesday, August 6*Strategic Plan Next Steps and November Workshop Plans

Dr. Allen discussed the plans for the Mission Bay Strategic Planning Workshop. The workshop is a joint NASA-community review of 2003 strategic plan inputs and program integration. Work will be done on components of the 2003 plan. It will be in November 2002 at the Islandia Hyatt Regency at Mission Bay, San Diego, CA. Invitees will include the SScAC, some members from the Subcommittees, technologists, other invited scientists, and NASA personnel. Although SScAC members are invited, this will not be an advisory committee meeting. The participants will discuss the treatment of several cross-cutting areas in the 2000 Plan (e.g., E/PO, technology, science assessment, partnering, and community research programs). Dr. Allen discussed the overall structure of the meeting. The first day, there will be presentations on inputs to the planning process. On the morning of the second day, the science objectives will be discussed. Cross-cutting elements will be addressed in the afternoon. On the last day, there will be a session on the long-range future, with an emphasis on public engagement. Dr. Allen discussed the new NASA vision and mission statement. The bulk of what OSS does is in the second element: to explore the universe and search for life. Under the new administration, there are different implications for NASA. Decisions are science-driven, not destination driven. Human presence beyond low Earth orbit will be enabled—as a means to scientific exploration, not an end in itself. Investments are justified by their contributions to the long-range vision. This is the framework in which the Space Science Strategic Plan must fit. By November, there should be much more clarity on the interface with the Agency plan. Dr. Allen distributed the Workshop agenda and reviewed it in more detail. Additional correspondence will be forthcoming to the key players. After the workshop, the NASA Headquarters staff will complete the preparation of the first draft of the 2003 Strategic Plan.

Discussion with the Associate Administrator

Dr. Christensen summarized the SScAC discussions. The Committee continues to be concerned about the successful completion of MER. A couple of common themes in the discussions were related to technology. Technology has been an issue for the Committee for some time. The SScAC is still concerned about the technology “gap”—the transition of technology at the low-TRL level (1-3) to technology that can be used on missions. Dr. Weiler noted that the New Millennium Program (NMP) was designed to address this issue. Hopefully, more mid-TRL (3-5) technology will fly on the NMP missions; however, there is still the small launcher availability issue. Dr. Christensen noted that the SScAC had identified this as a significant concern. Dr. McComas stated that in areas where there is no US launch capability, there should be an exemption to allow payloads to fly on foreign launch vehicles. Dr. Weiler suggested that the SScAC invite Mr. John Schumacher, who works NASA policy with the Congress, to address the Committee on this particular issue. Dr. Christensen indicated that with clear, convincing facts, the SScAC would like to carry the small launch vehicle issue forward to the NASA Advisory Council (NAC). Some action is needed at the Agency level. Dr. Weiler indicated that with SScAC request, he would ensure that the Committee received the appropriate information packages or briefings to prepare for this course of action. With respect to technology, Dr. Weiler indicated that a considerable portion of the OSS budget is going toward technology. For example, the Space Interferometer Mission (SIM) is spending about \$100M - \$200M on technology; NGST is spending hundreds of millions of dollars on new technology. Many of the NMP payloads are subsystems. The SScAC should get a cohesive presentation on focused technology across OSS. It should see the entire picture before drawing conclusions. OAT is more likely to fund technology that is cross-Enterprise rather than unique to OSS. OSS was very fortunate that OAT put a lot of funding into interferometers.

Dr. Christensen indicated that the SScAC would be proposing suggestions for the next GPRA assessment. With respect to the roadmaps and the decadal reports, in general, there is fairly good consistency between the two; however, the SScAC was skeptical on some of the cost assumptions in the decadal surveys. There may be more on the “plate” than will fit in the budget. The roadmapping activities are moving along very well, although there is some non-uniformity in approach, i.e., some of the Subcommittees are directly involved; in other themes, independent groups are doing the roadmapping work. Dr. Drake commented that there should be some way of keeping “corporate memory” intact. For example, a four-year appointment would provide some continuity between roadmapping activities. Dr. Weiler stated that this is a Division-level issue that should be worked with the Division Directors. With respect to E/PO, the SScAC

was pleased with the progress made in OSS. The Committee hopes that the lessons-learned in OSS are recognized by the new E/PO organization in NASA. The SScAC reiterated its support for the four science themes, with flexibility for cross-theme programs and activities. The ability to manage efficiently should not be compromised. The roadmap process and the Strategic Plan will proceed along those lines. Dr. McComas noted the issue related to responsibility for environmental monitoring at L1. Although this has become an operational activity, appropriate for hand-off to NOAA, the data are still needed for science missions. However, NOAA has been unable to secure funding for L1 monitoring. Dr. Weiler agreed that this is a NAC issue.

Committee Discussion

The SScAC discussed draft statements on the following topics: operational space weather observations at L1; launch capabilities for small spacecraft; nuclear power and propulsion; flagship missions; technology; the Mars Exploration Program; GPRA, and E/PO. Final statements and recommendations are contained in the letter to Dr. Weiler (Appendix D to this report).

The next SScAC meeting will be March 3-5, 2003, at JPL, Pasadena, CA.

Dr. Christensen adjourned the meeting at 11:30 a.m.

AGENDA

Space Science Advisory Committee

August 5-7, 2002
Room 7H46 (MIC-7)
Washington, DC

Monday, August 5

8:30	Opening Remarks	A. Christensen
8:45	Sun-Earth Connection Division	R. Fisher
9:00	Astronomy and Physics Division	A. Kinney
9:30	Solar System Exploration Division	C. Hartman
9:45	Mars Exploration Program Office	O. Figueroa
10:00	BREAK	
10:15	Report on the EPO Task Force	P. Knappenburger
10:45	Discussion	
11:45	Freedom-to-Manage Committee Webcast Project	M. Allen
12:00	LUNCH	
	Presentation: "OAT Technology Programs and Planning"	D. Andrucyk
1:00	OSS Status and Q&A	E. Weiler
2:00	Preview of GPRA Discussion	M. Allen
2:15	SEUS GPRA Report	R. Kolb
2:45	OS GPRA Report	A. Dressler
3:15	BREAK	
3:30	SSES GPRA Report	M. Drake
4:00	SECAS GPRA Report	D. McComas
4:30	Summary of Discussion on GPRA Assessments	A. Christensen

Tuesday, August 6

8:30	Chairman's Remarks	A. Christensen
8:45	Review of Space Studies Board Activities in Support of Planning	J. Alexander
9:00	Report on SSB Sun-Earth Connection Decadal Survey	L. Lanzerotti
9:30	Discussion	A. Christensen
10:00	BREAK	
10:15	Report on SSB Solar System Exploration Decadal Survey	J. Burns
10:45	Report on activities of the SSB Committee on the Origins of Life	J. Lunine (telecon)
11:15	Discussion on Decadal Surveys	A. Christensen
12:00	LUNCH	
	Science Talk: "View of the SEC from the Upper Atmosphere"	J. Kozyra
1:00	Report on the SEUS Roadmap	R. Kolb
1:30	Report on the OS Roadmap	A. Dressler
2:00	Report on the Solar System Exploration Roadmap	M. Drake
2:30	Report on the Sun-Earth Connection Roadmap	D. McComas
3:00	BREAK	
3:15	Discussion	A. Christensen
4:15	"One NASA": Integration of Long Range Planning	H. Thronson
5:00	Discussion and Assignments	A. Christensen

Wednesday, August 7

8:30	Strategic plan next steps and November Workshop Plans	M. Allen
9:00	Outbrief and Discussion with Associate Administrator	A. Christensen
		E. Weiler
10:00	BREAK	
10:15	Committee Discussion	A. Christensen
12:00	ADJOURN	

SPACE SCIENCE ADVISORY COMMITTEE
Membership List

Andrew B. Christensen (Chair)
NOAA/EUMETSAT

David L. Akin
University of Maryland

Charles A. Beichman
NASA/Jet Propulsion Laboratory

Alok Das
Air Force Research Laboratory/VSC

Michael J. Drake
University of Arizona

Alan M. Dressler
Carnegie Observatories

Jack D. Farmer
Arizona State University

Heidi B. Hammel
Space Science Institute

Dr. David Hathaway
NASA/Marshall Space Flight Center

Roderick A. Heelis
University of Texas at Dallas

Garth D. Illingworth
University of California, Santa Cruz

Judith T. Karpen
Naval Research Laboratory

Paul H. Knappenberger
Adler Planetarium and Astronomy Museum

Edward W. Kolb
Fermi National Accelerator Laboratory

Martin P. Kress
Batte Memorial Institute

David J. McComas
Southwest Research Institute

Jeremy R. Mould
National Optical Astronomy Observatory

John F. Mustard
Brown University

Kristen Sellgren
Ohio State University

Marc S. Allen (Executive Secretary)
NASA Headquarters

Appendix C

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
August 5-7, 2002**

MEETING ATTENDEES

Committee Members:

Christensen, Andrew B. (*Chair*)
Akin, David L.
Allen, Marc S. (*Executive Secretary*)
Beichman, Charles A.
Das, Alok
Drake, Michael J.
Dressler, Alan M.
Farmer, Jack D.
Hathaway, David H.
Heelis, Roderick A.
Illingworth, Garth D.
Karpen, Judith T.
Knappenberger, Paul H.
Kolb, Edward W.
Kress, Martin P.
McComas, David J.
Mould, Jeremy
Mustard, John F.
Sellgren, Kristen

NOAA/EUMETSAT
University of Maryland
NASA Headquarters
NASA/JPL
Air Force Research Laboratory
University of Arizona
Carnegie Observatories
Arizona State University
NASA/MSFC
University of Texas at Dallas
University of California, Santa Cruz
Naval Research Laboratory
Adler Planetarium
CERN
Battelle Memorial Institute
Southwest Research Institute
National Optical Astronomy Observatory
Brown University
Ohio State University

NASA Attendees:

Beasley, D.
Calabrese, Mike
Fischer, Richard
Frederick, Suzanne
Fullerton, Richard
Hasan, Hashima
Hartman, Colleen
Hertz, Paul
Jones, Vernon
Kinney, Anne
Martin, Gary
Moore, Mike
Norris, Marian
Rosendhal, Jeffrey
Sakimoto, Phil
Six, Frank
Slavin, Jim
Thronson, Harley
Vondrak, Richard
White, Nick
Woods, Dan

NASA Headquarters
NASA/GSFC
NASA Headquarters
NASA/JPL
NASA Headquarters
NASA Headquarters
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NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA/MSFC
NASA/GSFC
NASA Headquarters
NASA/GSFC
NASA/GSFC
NASA Headquarters

Other Attendees:

Alexander, Joseph
Appleby, John
Bauer, David
Beres, Kathleen
Boeck, Robert
Burch, Jim
Burns, Joe
Conte, Dom
Dewhurst, Brian
DiBiasi, L.
Herman, Dan
Holland, Michael
Kenyon, Dave
Malay, Jon
Margon, Bruce
Reese, Terry
Runge, Howard
Seife, Charles
Stabekis, P.
Talent, David
Zanetti, Lawrence

NRC/SSB
APL
TRW
Orbital
Boeing
SWRI
Cornell
Spectrum Astro
NRC
L. DiBiasi
Brashear LP
OSTP
Orbital
Ball Aerospace
STScI
Lockheed Martin
Orbital
AAAS/Science Magazine
Windermere
Lockheed-Martin
JHU/APL

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
August 5-7, 2002

RECOMMENDATIONS

SPACE SCIENCE ADVISORY COMMITTEE

August 14, 2002

Dr. Edward Weiler
Associate Administrator for Space Science
NASA Headquarters
Washington, DC 20546

Dear Dr. Weiler,

The Space Science Advisory Committee (SScAC) met in public session August 5-7, 2002 at NASA headquarters. We had a very good attendance by the committee, all members save one were there to consider the very full agenda placed before the committee. My thanks to Marc Allen and his staff for all their efforts in laying a foundation for a successful meeting. True, we had a heavy agenda, but it was well organized and also I believe your willingness to spend extra discussion time with us allowed us to feel comfortable with our understanding of the issues before us.

Your staff continued in the tradition of outstanding presentations. Richard Fisher, Anne Kinney, Colleen Hartman, Orlando Figueroa and Harley Thronson were to the point, informative and concise which allowed us to maintain the rather tight schedule. The meeting began with the briefings from the Division Directors who set the stage for the discussion on science issues that continued through the meeting. Much of our time was devoted to review of the on-going activities of the sub-committees in GPRA and Roadmap areas. We also devoted a morning to briefings by the Space Sciences Board on their decadal studies. We

were delighted to hear from Joe Alexander, James Burch, Joe Burns and Jonathan Lunine who presented the results of their panel deliberations. All items were of importance, and to make room for them it was necessary to delete from the agenda some items of interest to the committee. We will take up on these items at a future meeting, but they are highlighted herein for reference. Specific comments and recommendations are summarized below.

Operational Space Weather Observations at L1

The measurement of the space weather in the solar wind stream in front of the Earth's bow shock is important to the operational space weather communities in NOAA and DoD and in the scientific community. No research satellites are proposed; however, the Space Science Advisory Committee notes that many new initiatives identified in the Space Science Board Decadal Surveys and the NASA Roadmap activities presume continued monitoring of the interplanetary environment at or near the Lagrangian point L1.

The important question is which of the government agencies involved should provide the capability and which should assume responsibility for its maintenance. **The committee strongly urges NASA to engage all organizations that utilize measured solar wind variables, either for basic science or for space weather applications. The goal of these discussions should be to identify the responsible agency and the methodology by which monitoring of the interplanetary environment at L1 will be accomplished and maintained.**

Launch Capabilities for Smaller Spacecraft

The SScAC continues to be concerned about the status and future of launch capabilities for smaller spacecraft and payloads. We were unable to have a briefing on this topic as requested in our last letter, but appreciated receiving the short informal summary from Marc Allen. This short document highlights the basis for our concerns: 1) the Delta II is expected to be phased out later this decade and new launchers under development are expected to be bigger and more expensive; 2) The Athena vehicle is no longer available and while Pegasus has generally provided good service to Space Science, the larger Taurus has not yet launched such a mission; and 3) even for the limited set of orbits reachable as secondary payloads (e.g., GTO), few if any such opportunities are actually available in the U.S. There are several additional foreign launch options and the Ariane-5 provides routine opportunities for secondary payloads, however, the national launch policy precludes NASA paying for such launchers.

The paucity of reasonable launch options endangers Space Science's ability to carry through on its strategic plan and to carry out some of its most exciting smaller science-driven missions, such as the Explorers. The notion that this problem can be fixed by simply co-manifesting multiple payloads on a single large launcher will not work in general both because many of the missions need to reach unique orbits and because tying together schedules from multiple missions will cause delays and drive costs.

This is a very serious problem for OSS and probably also for ESS and the SScAC desires to engage in trying to help find workable solutions for it. **We request that OSS provide background information and support to SScAC as we develop our position prior to requesting the help and support of the NAC.**

Nuclear Power and Propulsion

Many space science missions are limited by power and propulsion constraints. Solar power falls off with the square of the distance from the Sun. Battery power is limited. The fundamental laws of physics require nuclear power and propulsion for any mission requiring high power and any mission requiring complex mission operations at the surface, in orbit, or involving multiple targets. Further, any mission beyond the orbit of Mars is enabled with nuclear power, and any mission beyond the orbit of Jupiter requires nuclear power.

The SScAC is concerned that budgetary pressures may lead to delay and budget reductions in the Nuclear Systems Initiative. We hope this can be avoided as much as possible. The program is important to the future of our science and we want to reiterate our strong endorsement of the Nuclear Systems Initiative proposed in the FY 03 budget.

Flagship Missions

Progress in the exploration of the solar system inevitably leads to discoveries that pose new questions, often leading to missions of increasing sophistication and complexity. Complex missions such as a Solar Probe and planetary orbiters, landers, and sample return missions address sophisticated questions, which tend to be more expensive than remote sensing and planetary flyby missions.

In general, the basic cost-capped mission lines do an excellent job of maintaining a reasonable launch rate while accomplishing many of our critical science objectives. However, certain scientific questions demand missions of a complexity, difficulty, and new technology that make them a flagship mission. They then rise above the level of present cost caps. For example, the high priority Solar Probe mission is expected to cost >\$0.5 B, far in excess of either the Solar Terrestrial Probe or LWS mission line caps. On the planetary side, the Europa Geophysical Orbiter and Mars Sample Return missions will exceed \$1B, far more than the New Frontiers Mission line cap. It must be remembered that the cost cap missions (e.g. Discovery and Explorer) are very low risk. It is through the development of Flagship missions that new technology is implemented that subsequently becomes appropriate for use in cost capped missions. It is therefore necessary to ensure there is a mechanism for carrying out flagship missions within all the OSS themes. It is not acceptable to simply gut the rest of these programs' lines to do a single flagship mission. **Rather, the SScAC advises that some other solution be found to accommodate occasional Flagship missions.** Could a mechanism be found, for

example, to augment the budget of a cost capped mission to accomplish a once-per-decade top priority science objectives represented by these rare flagship missions?

Technology

The SScAC appreciates the efforts of the Office of Space Science to identify the pacing technology initiatives for the space science missions of tomorrow, and continues to support the establishment of a comprehensive technology development program across all space science themes. The technology blueprint and technology assessment activities of the Solar System Exploration theme are to be applauded, as is the new initiative for nuclear space power and propulsion.

However, the Committee is concerned that Code S does not have its own well-defined technology program and budget. We understand following the excellent presentation by David Andrucyk that individual programs and projects are required to bear the financial and programmatic responsibilities for technology development past TRL 3, based on activities initiated by the Office of Aerospace Technology. Experience indicates that flight programs traditionally avoid the adoption of technologies below TRL 6 or 7, viewing technology development activities as a threat to budget, schedule, and mission assurance for flight programs. The practical effect of this policy is that numerous promising technologies languish in the “no man’s land” beyond TRL 3 for years or decades.

SScAC believes that technology development is a critical element of a successful space science program, and that Code S requirements are not being met by current policies. We note that the recently completed Technology Blueprint reports significant cases of lack of funding for development of high priority technologies and deficiencies in the definition of requirements in many others. We encourage Code S to continue its efforts to formulate a technology development strategy with adequate funding that bridges the gap in technology readiness levels and takes advantage of technology development activities within academia and other federal agencies.

The SScAC requests an integrated response from Code S and Code R to the technology roadmaps that are now being prepared. At the SScAC meeting in March, the technology requirements flowing from the Strategic plans should be reviewed in light of the Code R and Code S funding plans.

Mars Exploration Program

The SScAC heard a report on the status of the Mars Exploration Program as part of the presentation of Solar System Exploration Director Colleen Hartman, and also from the Director of the Mars Exploration Program Office, Orlando Figueroa.

We realize the importance of this mission to not only the Mars Exploration Program but to all of OSS. Hence we take great interest in its progress. At the March 2002 meeting, the SScAC expressed grave concern that the MER mission was dangerously close to a path of significant risk. The addition of \$100M additional resources apparently has had a very noticeable impact. Nevertheless, we share your concern that the MER mission still faces formidable challenges in schedule and cost. We believe you have a strong management team in place to address these issues and SScAC remains supportive of those who may need to make hard decision.

GPRA

With the OSS Strategic Planning meeting scheduled for November, our preparation of the GPRA reports came early this year. The SScAC reviewed the contributions from each of the four OSS themes and was very impressed with this year's scientific accomplishments.

Based on the 2002 GPRA reports, we discussed at length how to properly recognize the lack of progress toward a scientific question because of a delay in the launch of a key mission. The SScAC suggests that it might be a good idea to recognize explicitly, where appropriate, delays in the start of operations of major missions. It seems clear that, for a mission *for which there is no comparable source of scientific capability*, the loss of the mission rates a "red" in the GPRA report. It also seems appropriate to assign a "yellow" for the delay of a mission by a year or more. However, we believe a delay in a particular mission may be mitigated by citing progress in the same science area made possible by other missions. For example, this year the OS reported a "green" for the study of galaxy evolution even though SIRTf, whose data will be decisive for some questions, has experienced a year's delay. Offsetting this disappointment were important studies with HST that found a remarkably high stellar birth rate in very young galaxies. Furthermore the SM3B installation on HST of the Advanced Camera for Surveys, and the revival of NICMOS with the installation of a cryo-cooler provided a substantial increase in capabilities for galaxy evolution studies. Taken all together, the "green" rating is appropriate, but an explicit reference to the SIRTf delay is important for the credibility of the process.

Also, the SScAC suggests that, with beginning of the 2003 GPRA process, the theme scientists invite subcommittee members to submit suggestions of the year's most important scientific results in their discipline. This will broaden the perspective and should be helpful to HQ personnel in preparing the first draft of GPRA items. We also believe that the review process at SScAC would be facilitated with preview copies of the subcommittee inputs.

E/PO

The SScAC received a progress report from the E/PO Task Force, given by Paul Knappenberger. The Committee was pleased with the state of E/PO programs in the

OSS, which is both broadly-based and engaging. We believe their efforts to independently assess the impact of their programs are commendable. We encourage the Task Force to consider ways to enhance opportunities for young scientists interested in E/PO to develop experience in that area, perhaps through a NASA-sponsored E/PO fellowship program. We understand that plans are underway to reorganize E/PO programs at NASA, and encourage the Agency to preserve and build upon the successful model provided by the OSS.

Sincerely

Andrew B. Christensen
EUMETSAT/NOAA
Am Kavalleriesand 31
64295 Darmstadt
Germany

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters, Washington, DC
August 5-7, 2002**

LIST OF PRESENTATION MATERIAL¹

- 1) The Sun-Earth Connections Division [Fisher]
- 2) Astronomy and Physics Division [Kinney]
- 3) Solar System Exploration Division Update [Hartman]
- 4) Mars Exploration Program [Figueroa]
- 5) E/PO Task Force [Knappenberger]
- 6) Freedom-to-Manage Committee Webcast Project [Allen]
- 7) Technology Report: Introduction to OAT Presentation [Thronson]
- 8) OAT Technology Programs and Planning [Andrucyk]
- 9) OSS Status Report to Space Science Advisory Committee [Weiler]
- 10) FY02 GPRA Performance Report Science Theme Assessments [Allen]
- 11) OSS/SEU GPRA Metrics for FY02 [Kolb]
- 12) FY01 Progress on Enterprise Science Objectives [Dressler]
- 13) SSES GPRA Metrics [Drake]
- 14) Reporting on FY02 SEC Accomplishments for GPRA Assessment [McComas]
- 15) MER Assessment [Figueroa]
- 16) An Overview of the Space Studies Board [Alexander]
- 17) The Sun to the Earth – and Beyond; An Integrated Strategy for Solar and Space Physics, 2003-2013 [Burch]
- 18) OSS Advisory Committee Webcast Project [Allen]
- 19) New Frontiers in the Solar System; An Integrated Exploration Strategy [Burns]
- 20) Life in the Universe: An Assessment of U.S. and International Programs in Astrobiology [Lunine]
- 21) Beyond Einstein [Kolb]
- 22) NASA Exploration Team [Thronson]
- 23) Roadmap Guidance [Allen]
- 24) E/PO Task Force Progress [Knappenberger]
- 25) The Sun Earth Connection Roadmap 2002 Progress Report [McComas]

Other material distributed at the meeting:

- 1) NASA Space Science Enterprise Technology Blueprint
- 2) Informal Summary of Launch Vehicle Availability Outlook
- 3) Theme Roadmap Document Guidance
- 4) Space Science Strategic Planning Workshop

¹ Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code S, Washington, DC 20546.